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Imagination + x = Learning

"He was President of the United States in the eighteenth century."

Does that sentence read like mathematics to you? Well, it's the beginning of a lesson in painless algebra. There's nothing in it to memorize. No tables. No laws. No mystifying symbols. It's merely a statement that can be either true or false, depending on who is "he." If the name of Abraham Lincoln is put in the pronoun's place, the statement is patently false. If "he" is George Washington, the statement is obviously true.

This is plain, simple English, the language every American high school freshman understands. Mathematics is a different language, but it can be just as easy to read. Equations are merely statements about numbers that are true if you put in the right names; and numerals are only the names you use for numbers.

Numerals aren't "real" any more than names of people are real. You can see and touch the person Paul Jones, but the name "Paul Jones" itself is a mental invention. And although you can count the 10 fingers on your two hands, if you try to put one of these fingers on the number ten you find that the number exists only in your head. You can see a name for ten but you can't see the number ten.

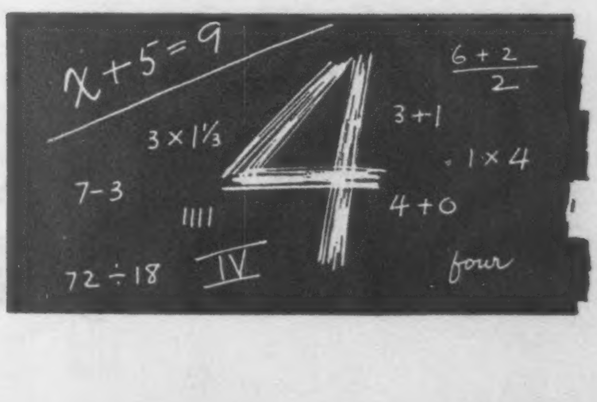
High school algebra, then, is nothing more nor less than the business of making statements about numbers that are true when you think up the right names. Take, for example, the equation: *x* plus 4 equals 9. The '4' and the '9' are names of numbers. If the language were English, the '*x*' would be a pronoun. But the language is mathematics. So the '*x*' is a "pronumeral." The only name you can put in place of that pronumeral to make a true statement is a name for the number five.

Could anything be more natural? Wouldn't mathematics be plain fun—even easy—to a youngster who approaches it this way? Yet many teachers will have trouble accepting this method because they have been taught that a child doesn't really understand anything that he can't explain in words.

Professor Max Beberman and a little band of mathematics experimentalists at the University of Illinois have set out to prove that this old rule of teaching is wrong. In an attempt to make math enjoyable to American children, they are turning the high school math curriculum inside out to make it fit what adolescents actually feel and think as opposed to the reactions ascribed to them by grownups.

"When you and I were thirteen, fourteen," Beberman reminds his fellow pedagogues, "we were enchanted by the mysteries of life. We weren't concerned with practicalities. We didn't ask ourselves how we would earn our living after we finished school. We wanted to know if there was a God, and if there was, what did He look like? Was He maybe like the light of day or the sound of the wind in the trees? Why was grass always green? Why were clouds always white or grey or sometimes pink—never blue like the sky behind them? The more abstract a question was the hotter we argued it. Angels absolutely delighted us; how many of them could dance on the head of a pin?

"Numbers are as abstract as angels. Mathematics is as creative as music, painting, or sculpture. The high school freshman will revel in it if we let him play with it as an



abstraction. But insisting that he pin numbers down is like asking him to catch a butterfly to explain the sheen on its wings—the magical glint of the sun rubs off on his fingers and the fluttering thing in his hands can never lift into the air again to renew his wonder."

Rather than asking a pupil to explain the fascinating tricks he sees numbers perform, Beberman and his colleagues discourage verbalization as long as they can without frustrating creative curiosity. "You don't ask a boy or girl to dissect his response to the first seascape he sees or the first string quartet he hears," the professor shrugs amiably. "Why expect a description of a mathematical operation?" Not only is non-verbal awareness enough in the beginning, it is preferable, because the language of mathematics is the most exacting tongue man has ever devised, and it can be mastered only gradually through an initial intuitive appreciation followed by long and patient practice.

To grownups who instinctively reject this philosophy, Beberman, using a favorite practice of his colleague, Miss Gertrude Hendrix, will ask: "Tell me, what is the sum of the first 60 odd numbers?" When a startled hearer pleads for time and a computer, Beberman seizes a tablet of paper and a pencil. "Let's list the numbers here," he proposes, writing:

1st odd number	total of 1
2	(1 plus 3) 4
3	(1 plus 3 plus 5) 9
4	16
5	25
6	36

He pauses momentarily and says, "Whenever you think you can tell me the sum of the first 60, stop me" and goes on

7	49
8	64
9	81

Slowly it dawns on his watching companion that each number listed in the right-hand column is equal to the opposite number in the left-hand column multiplied by itself. Beberman stops writing and says, "Fine. Now how would you describe what you recognize to be true?"

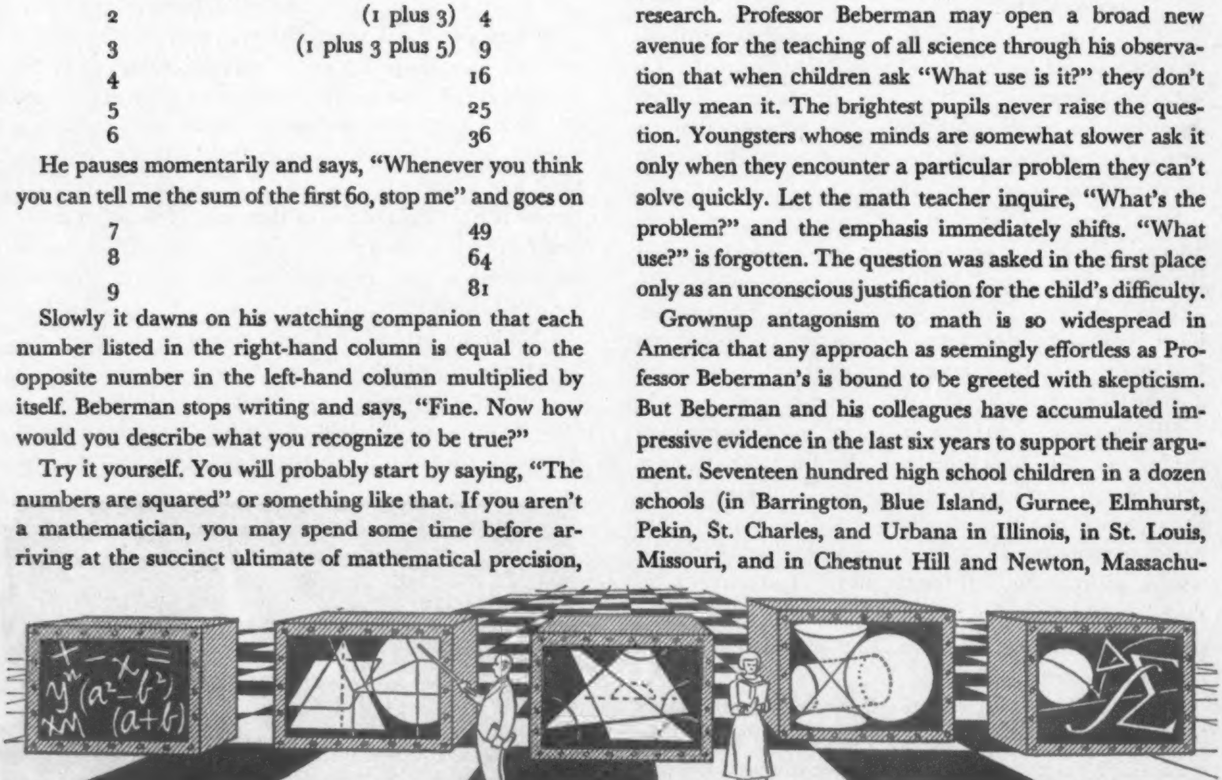
Try it yourself. You will probably start by saying, "The numbers are squared" or something like that. If you aren't a mathematician, you may spend some time before arriving at the succinct ultimate of mathematical precision, which reads: "The sum of the first 'n' odd numbers is n^2" ('n' being the pronumeral for the name of any whole number you care to put in its place). Nevertheless, you will recall that you did see, merely by glancing at the paper, an almost magical relationship between the two columns of numbers. And you understood the relationship sufficiently to predict that the sum of the first 60 odd numbers would be 3600.

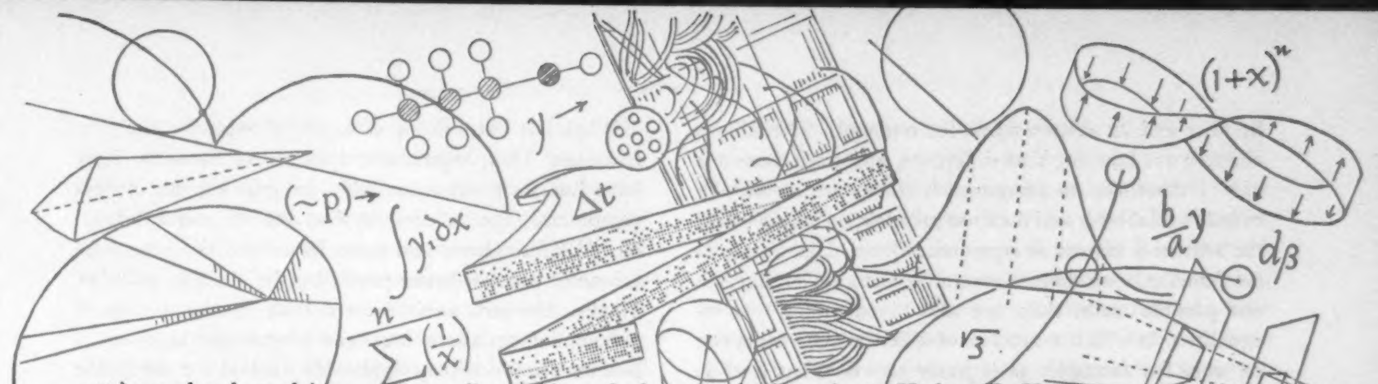
That tantalizing relationship between the two columns of numbers delights an adolescent mind. It tempts the question, "What makes it come out that way?" If the child is encouraged to guess the whyfor—as Beberman pupils are—he soon will be formulating the underlying principles of mathematics for himself, in his own ingenious and sometimes ingenuous language, instead of waiting to hear them pronounced by the teacher in words that inevitably bear the unwelcome sound of laws fixed by grownups.

What's the problem?

"Why?" is a question which too often atrophies and dies after we leave adolescence behind. Adults who were never freely exposed to math's fascination while they were at the susceptible age—that is, most of us—are far more likely to ask, "Of what use is it?" This is the question which all scientists, not merely mathematicians, will recognize as the great "practical" barrier to appreciation of fundamental research. Professor Beberman may open a broad new avenue for the teaching of all science through his observation that when children ask "What use is it?" they don't really mean it. The brightest pupils never raise the question. Youngsters whose minds are somewhat slower ask it only when they encounter a particular problem they can't solve quickly. Let the math teacher inquire, "What's the problem?" and the emphasis immediately shifts. "What use?" is forgotten. The question was asked in the first place only as an unconscious justification for the child's difficulty.

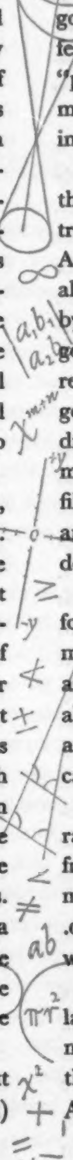
Grownup antagonism to math is so widespread in America that any approach as seemingly effortless as Professor Beberman's is bound to be greeted with skepticism. But Beberman and his colleagues have accumulated impressive evidence in the last six years to support their argument. Seventeen hundred high school children in a dozen schools (in Barrington, Blue Island, Gurnee, Elmhurst, Pekin, St. Charles, and Urbana in Illinois, in St. Louis, Missouri, and in Chestnut Hill and Newton, Massachu-





setts) are already studying math according to his method and are successfully learning principles not ordinarily grasped, if at all, until the college years. Although word of the course has been spread mainly by mouth and the texts are available only in mimeographed pages, 425 high schools and 128 colleges throughout the country have purchased individual sets of these teaching materials. A number of other city and county school districts have expressed interest in joining the experiment. Even adults have become infected by the yearning to learn a supposedly deadly subject in a lively way: employees of the Polaroid Corporation in Cambridge, Massachusetts, are filling classrooms and standing in the aisles. The snowball effect of all this has created a paradox, with Beberman and his group of mathematics evangelists actually trying to slow down the rate of conversion.

Because an entirely new teaching method is involved, every teacher who participates must be especially trained. All who now teach the system have spent at least a couple of weeks in special sessions in Urbana, where the project was launched in 1951 to improve the mathematical understanding of prospective students at the University of Illinois school of engineering. After returning to their respective classes, the teachers have the continuing benefit of face-to-face consultation with the Illinois staff. Miss Hendrix, teacher coordinator for the project, visits each participating school several times a year, as do Beberman and others. They watch the classes in action, often take over the teaching for an hour or two, and talk with the teachers at length about their various problems and ideas. Between consultations, each participating teacher writes a weekly report on his class's (and his own) progress. He tells what questions the pupils raise, at what points in the text they appear to stumble, what lesson examples get the best response.



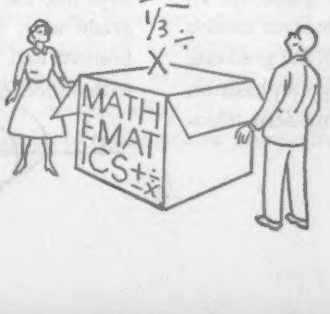
These observations suggest constant revision of the text (one reason why the math "books" are mimeographed) and provide a practical leavening of the theories and concepts which Illinois' "pure" mathematicians would like to see taught. But nothing goes into the "books" merely because it appeals to the pupils. The proposed amendments go back again to Herbert E. Vaughan, associate professor of mathematics at the University (his hours as "part-time" consultant to the project are longer than most men's "full time") for a final assurance that the text writing staff has done no violence to mathematical principles.

What comes out in the end is more a change in emphasis than in content. Along with that goes a change in the traditional sequence in which high school math is taught. A full four-year course used to begin with one year of algebra followed by one year of plane geometry followed by another year of algebra followed by a semester of solid geometry followed by a semester of trigonometry. (A relatively small percentage of American high school pupils go the whole route. Many of those preparing for college drop out after the first two years, when the math requirement for entrance to most United States colleges is fulfilled.) Under the Illinois system pupils follow threads of arithmetic and algebra and geometry all through, and so develop a feeling for the essential unity of all mathematics.

To get an idea of how the subjects are woven together, follow the freshman course. Traditionally called "elementary algebra," it is known in the Illinois system simply as "First Course." It is mainly, but not all, algebra. It is also a little arithmetic and a little geometry. And first, last, and always, it is a course in which language receives very careful attention.

On their first day in class, the pupils get copies of a rather pathetic arithmetic test paper done by an imaginary friend living in Alaska. This poor boy thinks that 5 and 7 make 57, and that 9 goes into 99 twice. He also asserts that .000065 is larger than .25, and he can prove it: he measured with a ruler.

The children, who already know a little arithmetic, laugh at his errors. But if they just "know" (i.e., have memorized) a little arithmetic without understanding it, they have some trouble at first in saying just how their Alaskan pen pal got so far off base. If you take a '5' and add a '7' to it, don't you get '57'? You do, of course, if you are putting one mark on paper next to another; you don't if you are adding the numbers five and seven. The distinction lies in understanding the difference between a



number and its written name (or numeral). The Illinois children are learning that difference, and from there it is only a short step to pronumerals (these are technically called "variables") and their use to satisfy, or "make true," the sentences known as equations. Once plain equations are familiar, with their comfortable custom of stating the one possible truth, there are also "inequations," or inequalities, in which a number of different statements can be true. For example: $3x$ is *greater than* 6. What is x? It could obviously be 3, since three 3's are nine. It could be $84\frac{1}{2}$. It could, in fact, be any number larger than 2. But this is a problem usually encountered by students in calculus classes. Why teach it in high school?

"We find that introducing inequalities at this level is useful," Beberman explains, "because it teaches kids early that there are many *equations* in which lots and lots of numbers will work. A grasp of this notion will be very important to them in higher mathematics. And it gives them a better understanding of what they are doing right now. We are trying to present math as a body of ideas rather than a collection of skills."

The concept of sets

The most pervading mathematical idea that the Illinois experiment tries to propagate is the concept of sets. Sets in themselves are old, but their presentation as a point of view is new. A set is any collection of things. The things can be numbers, points, lines, vectors, physical forces, people, or a set can be a philosophical notion such as brotherhood. By thinking in terms of sets, children learn to see apparent relationships, discover hidden patterns, and invent new arrangements to meet new problems. Having evolved this habit of thinking, they forget the details and retain a mental discipline which can be useful in such advanced modern mathematical techniques as public opinion sampling, statistical testing of the validity of drugs, programming of high speed computers, or calculating the orbit of a man-made moon from the position of "beeps" in the sky.

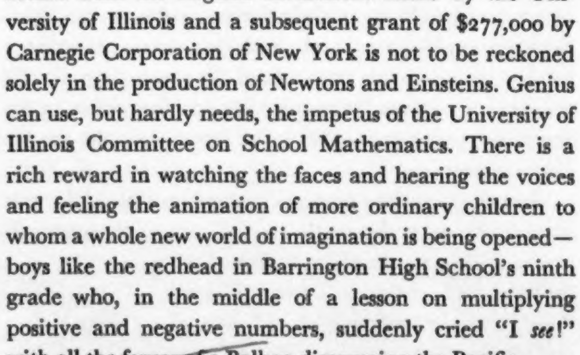
The concept of sets is brought into the new math course at the ninth grade level (it could be done earlier, Beberman says, perhaps as early as kindergarten, with sets of toys) and carried throughout the four high school years. Solutions and graphs (or "pictures") of inequations (as well as equations) are touched on in all the courses. There is heavy emphasis on analytic geometry (usually studied in the freshman college year) from the ninth grade up. In tenth grade, pupils are presented with numerous models of postulate systems (usually not taught until the graduate level of college). Twelfth graders get heavy emphasis on the circular functions, which are part of modern trigonometry.

What has been dropped to make room for the new materials? First, logarithmic solutions of triangles. They have lost their old value with the growing use of desk computers. The alleged derivations of mensurational formulas for spheres and cones have been cut from solid geometry because better proofs can be given in calculus. Finally, Horner's method for finding irrational roots of polynomial equations has been abandoned in favor of Newton's more widely applicable method for doing the same thing.

Teachers of the Illinois method are almost unanimous in saying that, although it is more fun to teach math this way, it is also much more work. (Some schools have arranged for the experimental teachers to have a little free time for preparation.) "The youngsters' questions can be really tough," one teacher who has been through the mill reports, "and the subject matter is tough, too. Still, I never liked being a drill sergeant, which is about what I felt I was under the old method."

That's identically what math pupils felt the math teacher was under older systems of teaching. And the youngsters are appropriately enthusiastic over the change. Not only the talented boys and girls who attend the University of Illinois High School in Urbana (an experimental school where the new course was launched in expectation that only unusually bright children would respond) but other pupils in public high schools take to math's abstractions with pleasure. More pupils under the Illinois program go on to the third and fourth year of math than do children who receive conventional math teaching. The original thought that the new approach would have to be limited to college preparatory candidates is gradually being revised by experience to include more high school enrollees.

This fall the first group of tomorrow's citizens who have been exposed to a full four years of the new ideas entered college. Their success in higher mathematics will be a rigorous practical test of the innovation's value. But the return from the original investment made by the University of Illinois and a subsequent grant of $277,000 by Carnegie Corporation of New York is not to be reckoned solely in the production of Newtons and Einsteins. Genius can use, but hardly needs, the impetus of the University of Illinois Committee on School Mathematics. There is a rich reward in watching the faces and hearing the voices and feeling the animation of more ordinary children to whom a whole new world of imagination is being opened—boys like the redhead in Barrington High School's ninth grade who, in the middle of a lesson on multiplying positive and negative numbers, suddenly cried "I *see*!" with all the fervor of a Balboa discovering the Pacific.



The successful launching of an artificial satellite on October 4 stirred wonder and anxiety in the breasts of Americans—perhaps, most of all, anxiety.

The event will no doubt stimulate the government to take whatever short-run measures are necessary in the national interest. It would be regrettable if the concern of the nation exhausted itself in such short-run measures.

Sensible people will bear in mind that in the long run our answer and our hope must be an intensified effort to create in this country a vigorous, excellent, well-rounded educational system at all levels, a strong and well-supported effort in all fields of fundamental research, and a deep-rooted respect for the life of the mind. To a society functioning in our tradition, these are the basic ingredients not only of scientific excellence, but of all advancement of knowledge. It is ironic that some of those who have reacted with most alarm to the event of October 4 have been very indifferent cultivators of these basic strengths.

John W. Gardner

Teaching the Teachers of Science

It is to labor the obvious unmercifully to say that the quality of precollege mathematics and science instruction has become a national concern.

The problem is a huge one. How to enlist more good science teachers; how to keep them in the profession; how to see that they are decently paid; how to supply them with information and equipment that will enhance their accomplishments on the job—these questions face each of the 48 states and more: each school system, each individual school. In our traditionally diverse pattern, the answers will vary from place to place, which is as it should be. But national efforts also are being made—two of them spearheaded, fittingly enough, from the nation's capital. Two organizations—the American Association for the Advancement of Science and the National Academy of Sciences-National Research Council—are lending their knowledge, prestige, and memberships to attempts to improve scientific and mathematical instruction throughout the country. And their education programs are being carried on in very close cooperation.

The AAAS *program*

An ultramodern building on Massachusetts Avenue in Washington is headquarters for the 50,000 members of the American Association for the Advancement of Science (AAAS). Those members, widely scattered over the U.S., hold positions in university faculties, industry, and government; some are high school teachers; they are influential, in one way or another, in their own communities. It is through these members—and the 258 other scientific organizations associated with it—that the AAAS feels it can make its greatest contribution to the national problem.

Under a science teaching improvement program (STIP) inaugurated two years ago with a Carnegie grant of $300,000, the AAAS has worked in many ways to develop good working relationships between scientists and educators, particularly through their professional organizations.

One of STIP's main aims is to encourage college and university scientists to accept responsibility for science teacher education and the improvement of secondary school programs in science. This, STIP believes, is all-important. It has, until recently, been all too difficult for high school science teachers to find university summer courses well tailored to their needs. Often college scientists, deeply interested in their own advanced research and in producing top-level scientists, have abdicated responsibility for preparing good secondary teachers in their subjects. STIP's efforts in this line are fortified by its work with national and state certification organizations to raise the standards required for teaching science and math.

A pilot project for helping teachers already in service is now in its second year. Four state universities—Nebraska, Oregon, Pennsylvania State, and Texas—have appointed staff scientists as counselors to consult throughout the state with high school science teachers. Each counselor sits down with individual high school teachers to talk with them about their problems, brings them information on other programs going on, tells them of readings, services, and new kinds of equipment, and invites them to the university campus. The counselors often speak before service clubs and other civic organizations to enlist community support for improving science teaching. A variety of people—high school principals, state education department representatives, and university scientists and administrators—have shown genuine enthusiasm for the plan. In addition to aiding individual schools (739 teachers in 128 schools were helped during the first year) the counselor plan is credited with helping develop good relationships among state education department personnel, university scientists, and secondary school personnel.

What the NAS *is doing*

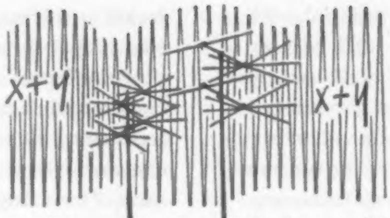
Within sight of the Lincoln Memorial, on Constitution Avenue, is the marble building housing the National

Academy of Sciences, which more than 35 years ago received a $5 million Carnegie grant. Within the past year, a $75,000 Carnegie appropriation was made to assist the Academy's National Research Council's newly formed Advisory Board on Education.

The advisory board, as does the AAAS educational department, plays a large role in cooperating with and coordinating educational activities undertaken by professional societies and other private and governmental organizations. It is also making available its expert knowledge in the relatively new fields of television and film scientific education.

The board is cooperating with the Columbia Broadcasting System in its projected television series, "Conquest," which will present the lives and accomplishments of scientists and will feature significant investigations to illustrate the nature and scope of scientific research. And a six-man film evaluation board has reviewed some 50 educational films on mathematics as background for recommendations regarding production and use of educational films. The board has also produced, in cooperation with the television unit of the Armed Forces Institute of Pathology and the AAAS, a course on calculus to be given by color television and recorded on color Kinescopes. The course, which is being offered by the University of Maryland for credit to mathematics and science teachers in the Washington area, will provide a test of the feasibility of using television as a medium for teaching abstract subjects.

One of the most dramatic accomplishments of the advisory board took place last summer at Lake Arrowhead. The NAS co-sponsored, with Hughes Aircraft, and in cooperation with the AAAS and UCLA, a Southern California industry-education conference. For one week representatives of Southern California industries, colleges and universities, and public school systems met



to discuss ways in which they could cooperate to strengthen scientific and mathematical education in the area.

Interestingly enough, one of the first conclusions the group reached was that undue concentration on purely scientific subjects should not be the only goal. Industry volunteered that its own best interests would be served if education is directed toward the broad cultural needs of young people growing up in a technological society rather than by merely urging students into careers in science and engineering.

At the conclusion of the conference, a continuing Southern California industry-education council was established. The conference broke up on a Saturday afternoon and the new council was operating by the next Monday morning—surely a speed record of some sort in the implementation of conference recommendations!

New Ways for Math in Junior High

Between sixth grade arithmetic and ninth grade algebra comes a lull in the child's occupation that is known as junior high math. It is in these two years that more time is wasted and more souls lost to mathematics than in any other period.

This is the view of John R. Mayor, director of education of the American Association for the Advancement of Science and part-time staff member of the University of Maryland. Under a Carnegie grant of $66,000 to Maryland, he is directing a three-year study of seventh and eighth grade mathematics. Some attention will also be given to the mathematics of grade 9.

As grades 7 and 8 are now taught, much of the time is given to so-called "social applications," and few new mathematical ideas are introduced. This results, Mr. Mayor believes, in lost time for both the mathematically talented and less talented youngsters. Those in the upper 50 per cent of their class are bored because little challenge is offered; those in the lower are resentful of the review and drill which only confirm them in their already apparent dislike of arithmetic. Studies of the psychology of learning support the belief that 12-year-old children are able to work with mathematical ideas which are considerably more abstract than are commonly offered in this country at the junior high level. And there is widespread interest in introducing more algebraic and geometric concepts in grades 7 and 8, at least for the upper 50 per cent.

The Maryland study, which got under way this fall, is steered by an advisory committee composed of representatives of the department of mathematics and the colleges of engineering and education at the University. Working closely with them are representatives of four school systems in the area: Prince Georges and Montgomery counties in Maryland, Arlington in Virginia, and the District of Columbia. Junior high teachers in the four systems will cooperate with the University committee in drawing up a new curriculum, preparing text materials, and trying them out in classes.

This issue of the Quarterly describes five Carnegie-supported programs for improving the teaching of mathematics and science. A sixth major project in this field, which will be described in a later issue of the Quarterly, is a study of the secondary mathematics curriculum being conducted by the Commission on Mathematics of the College Entrance Examination Board.

Man with an Idea

If it seemed to you, when you studied algebra, that "*x*" and many other symbols had a bewildering number of different uses, you may comfort yourself that you were right. And if you never learned any precise definitions for fundamental mathematical terms such as "variable"; if the noun "constant" appeared to be used in self-contradictory ways; if the term "indeterminate" seemed utterly obscure in its meaning—there is a mathematician today who understands your point of view.

Karl Menger, professor of mathematics at the Illinois Institute of Technology and the holder of an international reputation as a research mathematician, is the sworn and active enemy not only of the ubiquitous "*x*" but of all the inconsistencies in mathematical usage, terminology, and symbology which he claims are now rampant. They are the legacy, he says, of the Renaissance mathematicians, who despite their great contributions to the subject were possessed by a veritable "*x*-omania."

Why have mathematicians left this frame untouched for some 250 years? "It is obvious, since mathematicians *are* mathematicians, that they themselves managed to master the subject despite its antiquated frame," says Mr. Menger. "But is there any reason to think that the boy or girl who balks at it is therefore stupid?"

"No," cries Mr. Menger. As a matter of fact, those otherwise intelligent people who are "mathematical morons" will be heartened by Mr. Menger's assurance that actually some of the *best* minds are lost to mathematics in their early years. Often some quite logical youngster regards mathematics as "detached from—nay, opposed to—common sense. He mistakes mathematics for an abracadabra, and tries to guess the right incantation instead of approaching algebra rationally."

As an example of how this confusion can come about, Mr. Menger cites the one symbol "*x*," which in itself can have at least 12 different uses. In algebra, for instance, in the statement $x+5-x=5$ the student is expected to substitute for "*x*" any numeral, thereby obtaining, for instance, $4+5-4=5$ or $6+5-6=5$. In solving what is called the equation $x+1=5$, he is expected to find a particular number, "$x=4$" being the solution of the equation. In analytic geometry, "$x=4$" is called an equation, namely of a certain straight line. In this case the student is not expected to—indeed he must not—substitute a numeral for "*x*"; nor must he do so when he encounters the statement "the function x^2 is nonconstant." And take the word "variable." It too can have four or five different meanings. Hence when one encounters the phrase "the variable *x*" the possibility for confusion is compounded.

Mr. Menger is convinced that the continuing shortage of mathematicians and scientists will not be filled until the presentation of the basic concepts of mathematics is absolutely and impeccably rational. His crusade for clarification began during the war, when he was in charge of the mathematical education of the Navy V-12 trainees at Notre Dame University. "I tried to replace the stupefying routine with ideas," he says, "but found that this was difficult to do using conventional textbooks. It was this experience that really awakened my admiration (and sympathy) for those thousands of teachers who manage to achieve so much despite the imperfect traditional frame of concepts and symbols. My confidence in their ability inspired me to try to give them better tools to work with."

Mr. Menger's one-man war has been waged under notable handicaps. He has already produced two books on how he thinks math should be presented. For one, *Calculus—A Modern Approach*, he was unable at first to find a publisher, and so mimeographed and assembled it himself. ("I was lucky, in that I have a helpful wife and four helpful children," Mr. Menger remarks. "Not all men would have such a labor supply available, nor a basement big enough to carry out this huge and messy work.") After the mimeographed text received wide and favorable reviews in scholarly journals, Mr. Menger was approached by Ginn and Company, which published the work in 1955. It is now in its second printing. A more recent book (which Mr. Menger also varityped himself), *Basic Concepts of Mathematics*, was published through the Illinois Tech Bookstore. During the next three years, Professor Menger will receive hitherto lacking research and secretarial help through a Carnegie grant to Illinois Tech.

Mr. Menger sees his work as divided into three basic steps. First, he tries to give precise definitions to fundamental terms. Along with this go clear directions as to procedures to be followed and how symbols are to be manipulated. Each formula, instead of appearing simply as a string of symbols, should be accompanied by a legend explaining what the letters in the formula stand for. Moreover, the legend should make explicit whether the symbol, for example "*x*," imposes a task or is simply part of an assertion. In addition, Mr. Menger uses different typographical styles to indicate different uses for symbols. For instance, "*x*" when used as a numerical variable might be printed in roman type; when used for the abscissa it might be printed in italics. For some uses, he would em-

ploy another letter, say "*j*," or an entirely different symbol, such as an asterisk, for the traditional "*x*."

The vocabulary of the concepts and symbols should be developed as the epitome of common sense rather than as "esoteric magic," Mr. Menger believes. And finally and most important, the new way of presentation should be tried out on students, and revisions made according to their responses and needs.

Mr. Menger is proud that hundreds of adults attend, with seeming enthusiasm, his night courses on the new approach to calculus and the basic concepts of math. They are a small sample, but their frequent declarations that they now see more in math than they ever did before give substance to Mr. Menger's claim that the subject can and should be clarified.

NEW GRANTS

Grants amounting to $314,025 were voted during the final quarter of the fiscal year 1956–1957. The total appropriations for the year amounted to $7,285,009. The income for the year was $9,400,950, of which $2,265,000 had been set aside to meet commitments, including those for teachers' pensions, incurred in previous years.

Included among the grants voted during the last quarter are those listed below:

United States

American Assembly, for an assembly on the United States and Africa, $85,000.

Colorado College, for an experimental program in mathematics and science for the general student, $60,000.

University of Michigan, for a new undergraduate course on Asia, $26,625.

Commonwealth

Educational Testing Service, for psychometric fellowships for two students from the Commonwealth, $8,000.

Staff News

John C. Honey has joined the Carnegie staff as an executive associate. He was director of the government studies program of the National Science Foundation in Washington before he came to the Corporation.

Mr. Honey received the A.B. from Bard College, and M.A. and Ph.D. degrees from the Maxwell Graduate School of Citizenship and Public Affairs of Syracuse University. His government service included work with the Office of Price Administration and the Department of the Interior.

From 1950 until recently he taught courses in the school of public affairs of the American University in Washington. He was a visiting professor of public administration at the University of Puerto Rico from 1947 to 1949.

James W. Campbell has been appointed associate treasurer of the Corporation. He has been a member of the Carnegie staff since 1933 and assistant treasurer since 1953.

Frederick H. Jackson and Alan Pifer have been appointed executive associates. Both were formerly executive assistants.

Commonwealth Libraries Offered American Book Sets

By the end of the year, some 200 libraries in the Commonwealth will have received, as gifts from the Corporation, sets of 350 books about the United States. The shipment of the books, which began this month (October), represents the culmination of a three-year, $360,000 project.

Dozens of distinguished critics, historians, and authorities on all aspects of American life participated in the selection of the books, which were chosen to give a picture of present-day American civilization and its origins in history. The collection is intended to be illustrative not only of good American writing but of the entire range of American life and behavior. Included in the sets are books of fiction and nonfiction, biography and poetry, sociology and philosophy, reference books and picture books, books of humor and literary criticism.

Each set sent overseas is accompanied by a separate volume, *American Panorama*, edited by Eric Larrabee of Harper's Magazine. This book contains 350 book-and-author profiles by 15 eminent American critics. The volume was published by New York University Press.

CARNEGIE CORPORATION
OF NEW YORK

589 FIFTH AVENUE NEW YORK 17 N. Y.

Carnegie Corporation of New York is a philanthropic foundation created by Andrew Carnegie in 1911 for the advancement and diffusion of knowledge and understanding. It has a basic endowment of $135 million and its present assets, reckoned at cost value, are approximately $192 million. The income from $12 million of this fund may be used in certain British Commonwealth areas; all other income must be spent in the United States.

The Corporation is primarily interested in higher education and in certain aspects of public and international affairs. Grants are made to colleges and universities, professional associations, and other educational organizations for specific programs. In higher education, these include basic research, studies of educational developments, training opportunities for teachers and administrators, and other educational projects of an experimental nature. In public and international affairs, the Corporation is concerned primarily with research and training programs which promise increased understanding of the problems the nation faces and which provide better selection and training of young men and women who must deal with these problems.

Detailed descriptions of the Corporation's activities are contained in its annual reports, which usually are published in December.